

We Claim:

1. An apparatus for electropolishing a conductive layer on a wafer using a solution, comprising:  
an electrode assembly immersed in the solution configured proximate to the conductive layer having a longitudinal dimension extending to at least a periphery of the wafer, the electrode assembly including:

an elongated contact electrode configured to receive a potential difference;

an isolator adjacent the elongated contact electrode; and

an elongated process electrode adjacent the isolator configured to receive the potential difference; and

a voltage supply configured to supply the potential difference between the contact electrode and the process electrode to electropolish the conductive layer on the wafer.

2. The apparatus of claim 1, wherein the elongated contact electrode and the elongated process electrode are configured to electropolish the conductive layer on the wafer without physical contact with the wafer.

3. The apparatus of claim 1, wherein the electrode assembly includes a plurality of passages configured to provide solution flow through the electrode assembly.

4. The apparatus of claim 1, wherein the electrode assembly includes a plurality of elongated contact electrodes, isolators, and elongated process electrodes.

5. The apparatus of claim 4 further comprising a mechanism to produce relative motion between the electrode assembly and the conductive layer which provides electropolishing of substantially an entire surface of the conductive layer.

6. The apparatus of claim 5, wherein the mechanism produces reciprocating motion between the electrode assembly and the conductive layer on the workpiece.

7. The apparatus of claim 5, wherein the mechanism produces rotational motion between the electrode assembly and the conductive layer on the workpiece.

8. The apparatus of claim 4 further comprising a workpiece holder configured to hold the wafer and produce rotational motion between the electrode assembly and the conductive layer on the workpiece.
9. The apparatus of claim 1, wherein the isolator protrudes above a plane defined by the elongated contact electrode and the elongated process electrode.
10. The apparatus of claim 9, wherein the isolator includes a pad having a top surface to contact the conductive layer and planarize the conductive layer.
11. The apparatus of claim 10, wherein the top surface of the pad is abrasive.
12. The apparatus of claim 10, wherein the pad is disposed on the isolator.
13. A system for electropolishing a conductive layer on a wafer using a solution, the system comprising:  
a workpiece holder configured to hold the wafer exposing the conductive layer to the solution;  
an electrode assembly immersed in the solution configured proximate to the conductive layer and extending past a periphery of the wafer, the electrode assembly including:  
a plurality of elongated contact electrodes configured to receive a potential difference;  
a plurality of elongated process electrodes adjacent the plurality of elongated contact electrodes configured to receive the potential difference; and  
a plurality of isolators adjacent the plurality of elongated contact electrodes and the plurality of elongated process electrodes and configured to insulate the potential difference between the plurality of elongated contact electrodes and the plurality of elongated process electrodes; and  
a voltage supply configured to supply the potential difference between the contact electrodes and the process electrodes to electropolish the conductive layer on the wafer.
14. The system of claim 13, wherein the elongated contact electrodes and the elongated process electrodes are configured to electropolish the conductive layer on the wafer without physical contact with the wafer.

15. The system of claim 13, wherein the electrode assembly includes a plurality of passages configured to provide solution flow throughout the electrode assembly.
16. The system of claim 13 further comprising a mechanism to produce relative motion between the electrode assembly and the conductive layer on the wafer which provides electropolishing of substantially an entire surface of the conductive layer.
17. The system of claim 13, wherein the workpiece holder is configured to produce rotational motion between the electrode assembly and the conductive layer on the workpiece.
18. The system of claim 13, wherein:  
the power supply is configured to supply a first potential and a second potential difference;  
and  
the electrode assembly includes:  
a first group of plurality of elongated contact electrodes, isolators, and elongated process electrodes defining a first zone, the first group of plurality elongated contact electrodes and elongated process electrodes configured to receive the first potential difference to electropolish at a first rate; and  
a second group of plurality of elongated contact electrodes, isolators, and elongated process electrodes defining a second zone; the second group of plurality of elongated contact electrodes and elongated process electrodes configured to receive the second potential difference to electropolish at a second rate.
19. The system of claim 18, wherein the first group includes a plurality of consecutive elongated contact electrodes, isolators, and elongated process electrodes.
20. The system of claim 18, wherein the second group includes a plurality of consecutive elongated contact electrodes, isolators, and elongated process electrodes.
21. The apparatus of claim 18, wherein the isolators of the first group and the second group protrudes above a plane defined by the elongated contact electrodes and the elongated process electrodes of the first group and the second group.

22. The apparatus of claim 21, wherein the isolator of the first group and the second group includes a pad having a top surface to contact the conductive layer and planarize the conductive layer.